Forest Insect & Disease Management
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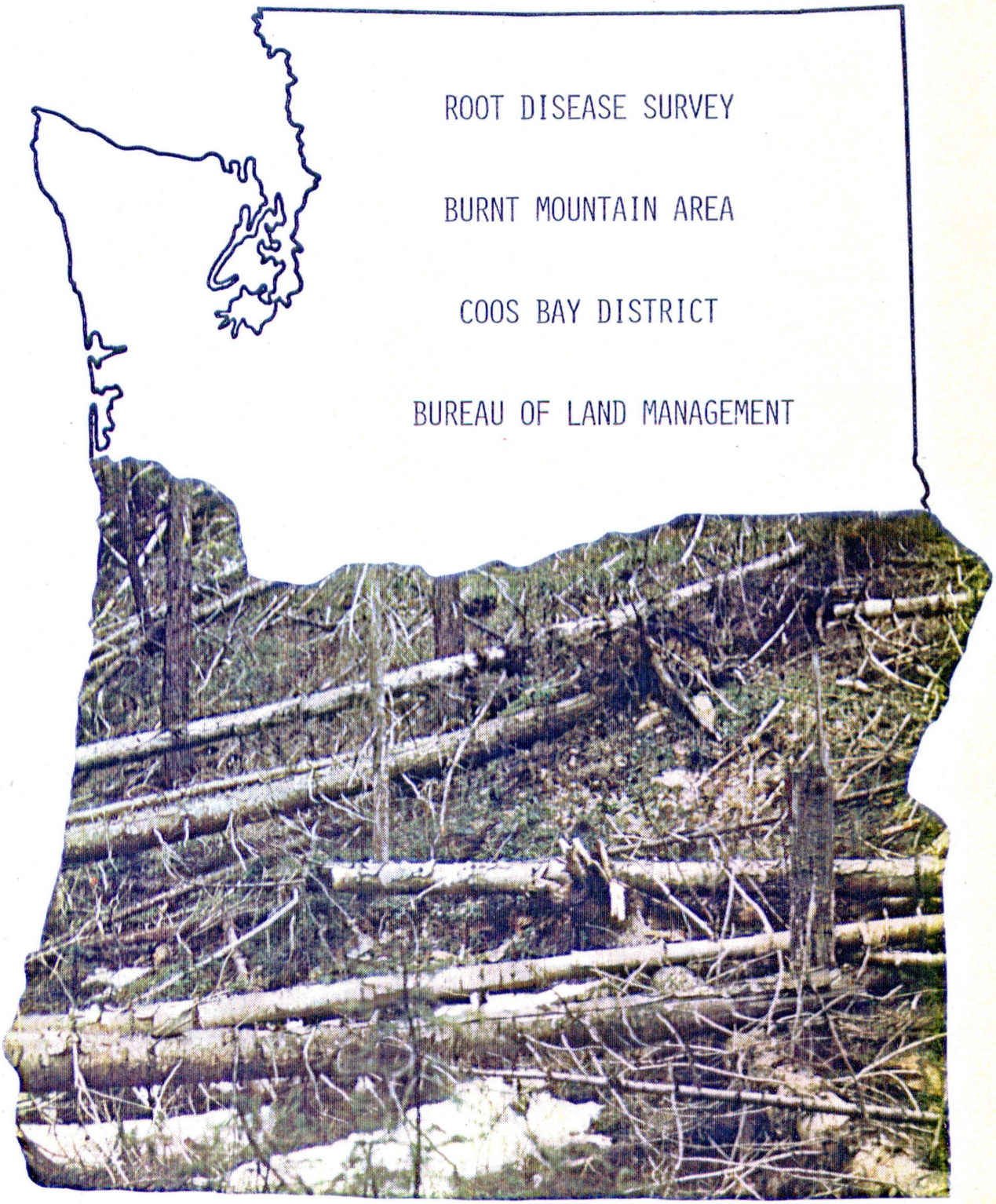
BURNT MOUNTAIN AREA

COOS BAY DISTRICT

BUREAU OF LAND MANAGEMENT



ROOT DISEASE SURVEY, BURNT MOUNTAIN AREA, COOS BAY DISTRICT, BUREAU OF LAND MANAGEMENT

by

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Appreciation is extended to Frank Price and Roger Rennie from the Coos Bay District, Bureau of Land Management for assisting in the field work.

INTRODUCTION

During the week of May 6-9, 1980, a root disease evaluation was done on the Burnt Mountain Area of the Coos Bay District, Bureau of Land Management. The unit examined was between Middle Creek and the Cherry Creek Road (T. 27 S., R. 11 W., secs. 21, 22, 27, and 28). Purposes of the evaluation were to determine identity and incidence of root diseases, quantify associated damage, and provide management recommendations to minimize present and future losses.

METHODS

For purposes of the evaluation, the area was divided into five subunits designated A, B, C, D, and E (Figure 1). Block A, a 98-acre stand, was systematically surveyed. Plots were located on a 5 x 2 chain grid across the stand (Figure 2), and a 40 factor prism was used to define each plot. All "in" trees, regardless of conditions (living, dead, standing, down) were tallied and had DBH measured. Two roots on opposite sides of each tree were excavated to a distance of 3 feet from the root crown, and exposed roots were examined for evidence of disease. Per acre basal area, number of trees, and board foot volume were calculated and tabulated by diameter class, species, and tree condition from prism plot data.

Approximately 300 acres in Blocks B, C, and D were examined less intensively. These areas were walked through and stumps or dead and symptomatic trees examined for evidence of root diseases. Location of diseased trees was mapped, and a general assessment of disease condition was made.

Block E was not examined.

RESULTS

Block A - The stand surveyed was composed predominantly of 50-year-old Douglas-fir (*Pseudotsuga menziesii*) with scattered western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Port Orford cedar (*Chamaecyparis lawsoniana*). The stand had been naturally seeded following logging in 1930. It was precommercially thinned in 1958 and fertilized in the early 1970's. In recent years, it was considered for commercial thinning, but the idea was rejected when stocking was found to be too low. Per acre basal area, number of trees, and board foot volume are summarized for the stand in Tables 1, 2, and 3.

Laminated root rot, caused by *Phellinus (Poria) weirii* was identified by the typical laminated decay and the occurrence of setal hyphae and ectotrophic mycelium. The disease was found in 19 of the 112 prism plots taken in the stand (17 percent). Distribution, as shown in Figure 3, was fairly intense in the southeast corner of the stand but otherwise rather spotty. Overall, laminated root rot was affecting 10.4 percent of the trees containing 8.0 percent of the volume. An additional 4.0 percent of the trees containing 2.5 percent of the volume had been windthrown. Though they were not infected by *P. weirii*, almost all of these occurred in and around laminated root rot centers where there were openings in the stand. The disease probably was responsible indirectly for loss of many of these trees since it caused their exposure to wind.

Shoestring root rot, caused by *Armillaria mellea*, was identified by the thick white mycelial fans under host bark, the occurrence of dark shoestring-like infective structures called rhizomorphs, and the stringy wet rot marked with numerous zone lines. It was found affecting 0.6 percent of the trees containing 0.3 percent of the volume. Most trees affected by shoestring root rot were suppressed, and many occurred in laminated root rot centers.

The Douglas-fir beetle (*Dendroctonus pseudotsugae*) was observed infesting some Douglas-fir in the stand. All infested trees were also infected by *P. weirii*.

Block B - This was a large clearcut area. A progeny test had been established along the Garbage Dump Road, and a small area was seeded to grass for game animal forage just south and southeast of Block A. Other portions of the unit were replanted with Douglas-fir. Before cutting, the old forest on the unit was mainly Douglas-fir, western redcedar, and western hemlock on the north end of the block and the latter two species on the south end.

Laminated root rot was detected in Douglas-fir stumps at several locations. Evidence of a fairly large and intense disease center was found just south of Block A. Other diseased stumps found were widely scattered individuals or very small groups. Locations of infected stumps are shown in Figure 1.

Block C - This was an old-growth Douglas-fir-western hemlock-western redcedar stand. As shown in Figure 1, there was a fairly large, severe, laminated root rot center on the northwest corner of the stand. Considerable windthrow and mortality had occurred recently in this area.

Block D - This was a 14-year-old Douglas-fir plantation covering about 100 acres. Natural cedar and hemlock regeneration was intermixed. The stand is under consideration for precommercial thinning in 1981. Because of its proximity to the laminated root rot in Block C, the District has concerns about possible root disease in this plantation.

One *P. weirii*-infected Douglas-fir was found at the west end of the plantation. No other infected saplings or stumps from the previous stand were detected in the walk-through examination.

Block E - Stands in this block were old-growth and old plantations. They were not examined in this evaluation because of time limitations and the District's more immediate need for information on the other areas. The likelihood of some laminated root rot occurring in Block E is great.

DISCUSSION

By far the most important disease in the surveyed unit is laminated root rot. Other problems are very minor. Laminated root rot is distributed across much of the area. Disease intensity is generally light except at the southeast corner of Block A, adjacent portions of Block B, and at the northwest corner of Block C.

Laminated root rot is a particularly dangerous disease because the causal agent is persistant on the site. It can survive for long time periods (up to 50 years) in roots of old stumps, infecting new hosts that become established on the site via root contacts. Infection centers develop and increase in size due to subsequent spread from tree to tree along roots.

Recommended control for laminated root rot is to cut all susceptible hosts in infection centers and a 50-foot buffer around each and (1) mechanically remove all inoculum (infected roots and stumps) or (2) leave inoculum but replant with immune, resistant, tolerant, or intermediate tree species.

Mechanical removal of inoculum is effective and allows the manager to replant with any tree species desired, but it is expensive ($250-$450 per acre), difficult on steep terrain, and may contribute to soil damage. Species manipulation in disease centers is often a more viable control alternative.

In the Burnt Mountain area, tree species by decreasing degree of susceptibility are: immune-hardwoods; resistant-cedars, hard pines; tolerant-soft pines; intermediate-western hemlock, Sitka spruce; susceptible Douglas-fir, and true firs. If only immune species are grown for a rotation (50 years or more) on an infected site, *P. weirii* should die out and Douglas-fir could be grown in the following rotation with almost no likelihood of additional losses. If resistant or tolerant species are used, there should be much the same result, although there may be a small amount of infection and retention of the pathogen. If intermediate species are grown for a rotation, they should suffer little damage. However, many will be infected and the disease will be maintained on the site. Planting with Douglas-fir in the subsequent rotation would be dangerous.

SPECIFIC MANAGEMENT RECOMMENDATIONS

Block A = (1) Treat the intensely diseased area in the southeast corner of this stand as soon as possible. Salvage-log the diseased area plus a 50-foot buffer then consider (a) stump removal on the site followed by replanting with Douglas-fir, or (b) replanting the area with immune, resistant, or tolerant tree species (red alder and/or cedars are adapted to the site and would be preferred choices). (2) In the remainder of the stand, immediate treatment is not recommended. Disease distribution is spotty, infection centers are small, and access is poor, so salvage of infected trees would be difficult and probably not economically justifiable. Presently, growth of uninfected trees probably offsets disease-caused loss. We recommend that this portion of the stand be monitored carefully with surveys done at 10-year intervals. If disease damage increases in the future, consider the possibility of harvesting the stand early and treating the infection center areas with stump removal or by manipulating tree species.

Block B = (1) Treat the intensely diseased area adjacent to Block A. Remove stumps, plant with immune or resistant species, or set the diseased area aside as a big game forage area with no trees (if this is done, periodically rogue out natural Douglas-fir regeneration). (2) In the remainder of the block, no disease treatment is recommended.

Block C = Consider harvesting the entire stand or at least the northwest portion. Following harvest, treat the laminated root rot center in the northwest corner by stump removal or changing tree species.

Block D = Continue the normal management program. Thin the plantation as planned. Consider leaving natural cedar regeneration as crop trees in the portion of the plantation adjacent to the root rot center in Block C.

Block E = Consider surveying these stands for laminated root rot in the future.

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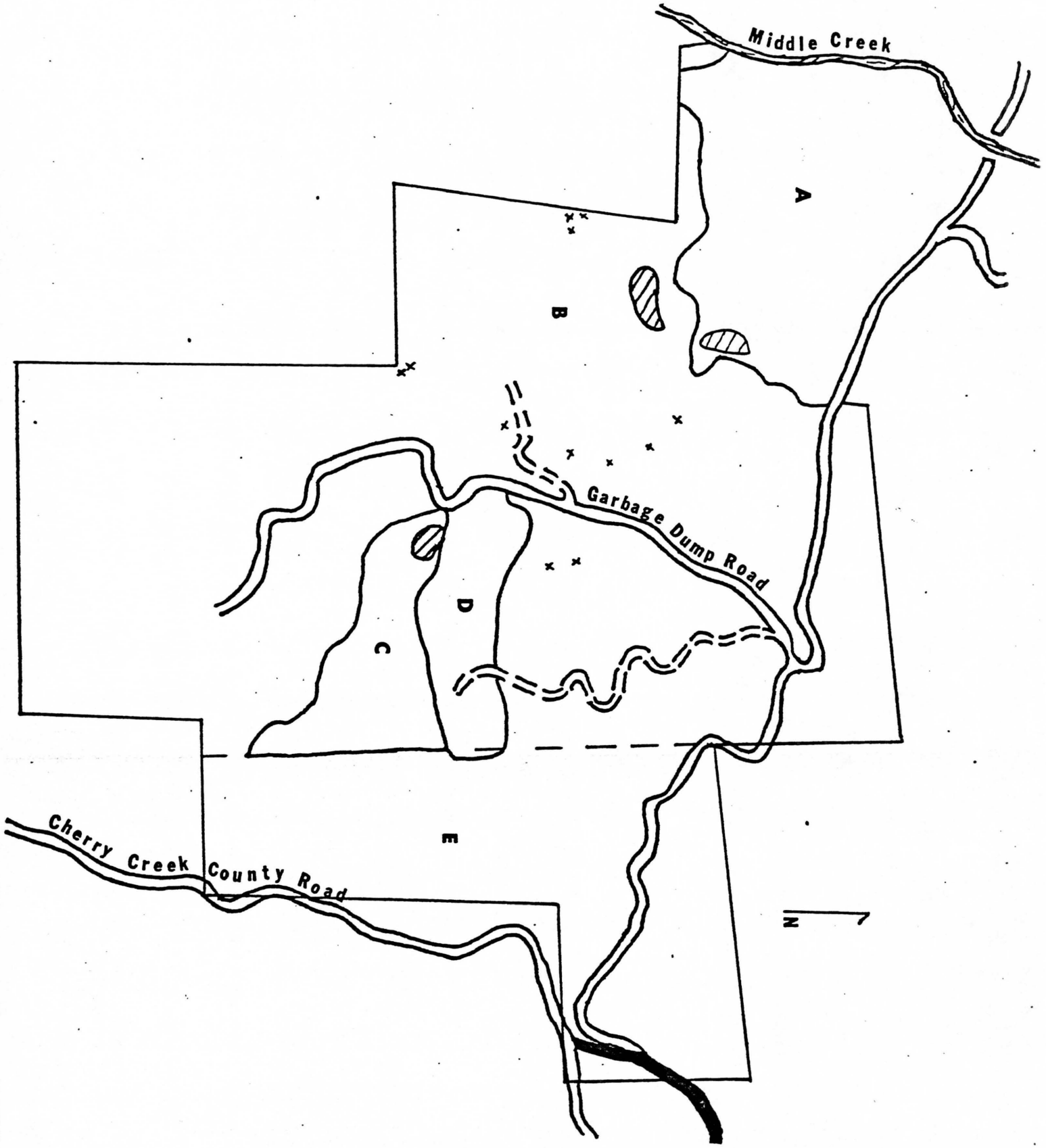

Figure 1--Areas surveyed in Burnt Mountain root disease evaluation. Cross hatched areas are severe laminated root rot centers. Small x's indicate approximate location of individual infected stumps not in disease centers.

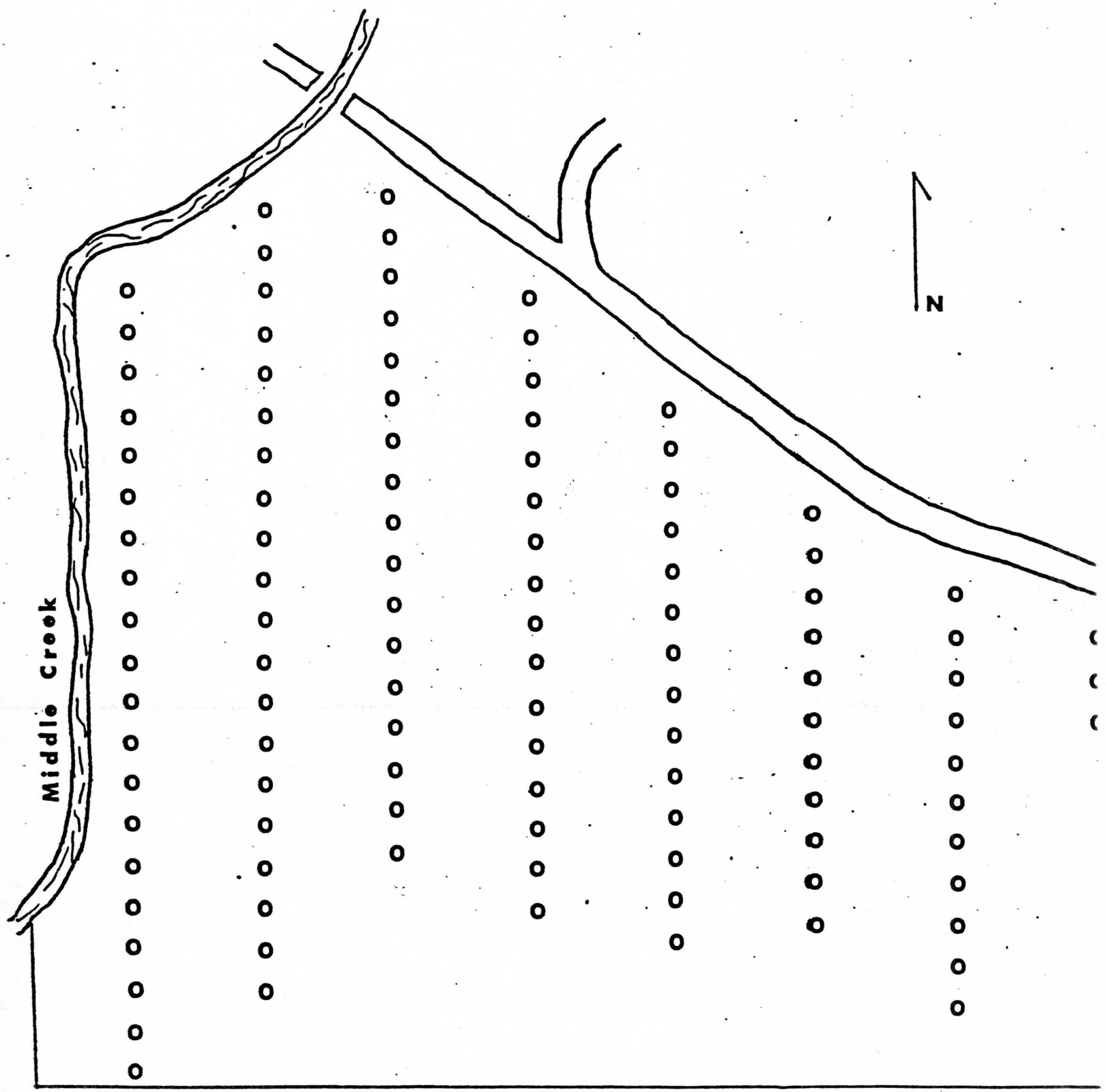

Figure 2--Plot layout used in sampling Block A.

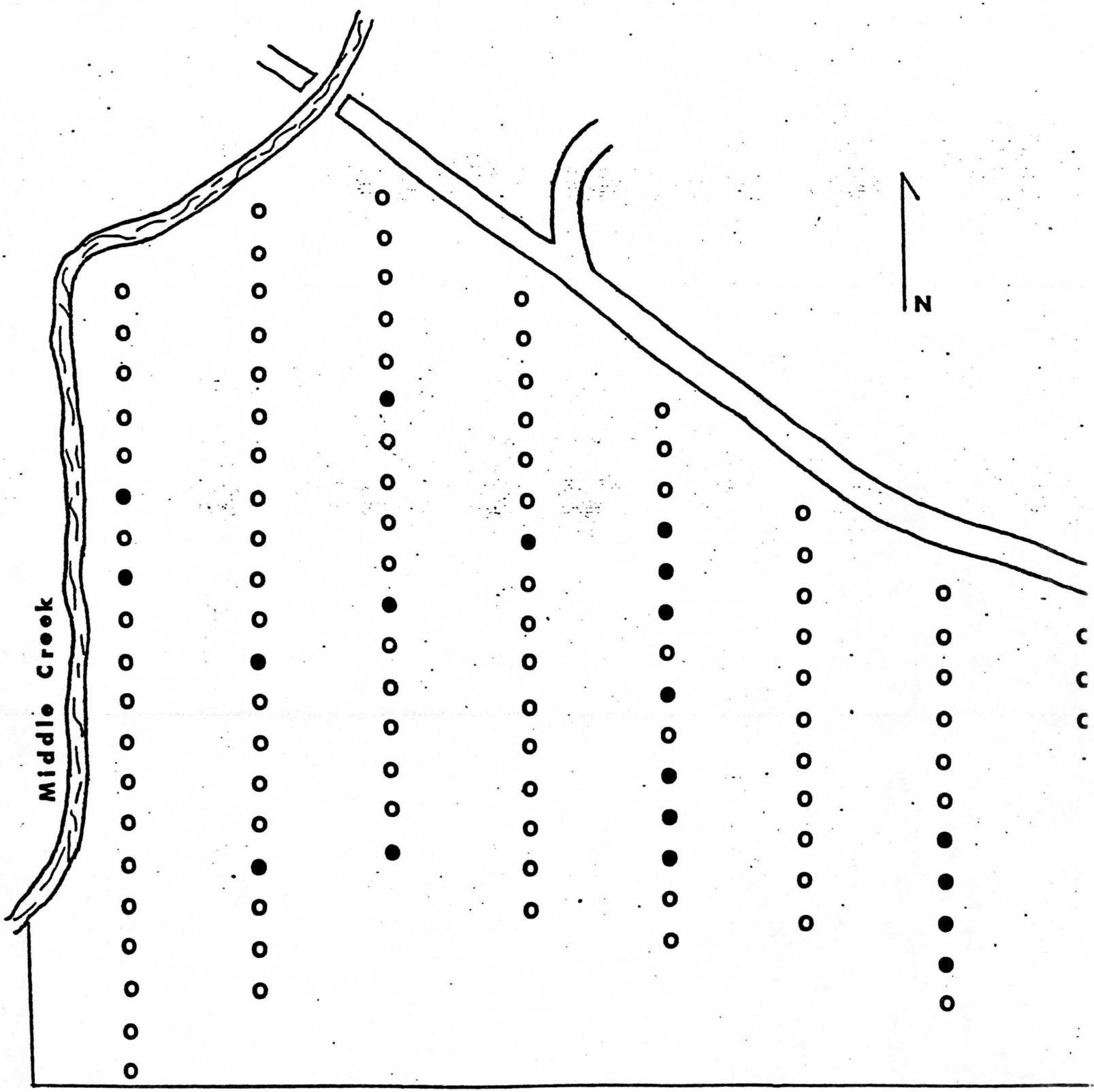

Figure 3--Location of plots in Block A with laminated root rot (solid circles).

TABLE 1. Mean basal area per acre (ft.^{2}) in Block A of Burnt Mountain Unit

DBH Class (in.)	DOUGLAS-FIR			WESTERN HEMLOCK		PORT ORFORD CEDAR	WESTERN RED CEDAR	ALL TREE SPECIES	
	Healthy	*P. weirii* infected	Other Disease or Windthrow	Healthy	*P. weirii* infected	Healthy	Healthy	Healthy	Diseased or Windthrown
8	4.8	0.8	0.8	0.8	0.0	0.0	0.8	6.4	1.6
10	10.4	1.6	1.2	1.6	0.4	0.0	1.6	13.6	3.2
12	13.6	3.6	0.4	0.8	0.0	0.4	0.8	15.6	4.0
14	16.8	2.0	0.4	0.8	0.0	0.0	0.4	18.0	2.4
16	18.0	0.4	0.0	0.4	0.0	0.0	0.0	18.4	0.4
18	15.2	0.4	0.8	0.4	0.0	0.0	0.0	15.6	1.2
20	10.4	0.8	0.4	0.0	0.0	0.0	0.0	10.4	1.2
22	7.6	0.4	0.0	0.0	0.0	0.0	0.0	7.6	0.4
24	2.4	0.4	0.0	0.4	0.0	0.0	0.0	2.8	0.4
26	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
28	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42+	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
All Classes	103.6	10.4	4.0	5.2	0.4	0.4	3.6	112.8	14.8

TABLE 2. Mean number of trees per acre in Block A of Burnt Mountain Unit

DBH Class (in.)	DOUGLAS-FIR			WESTERN HEMLOCK		PORT ORFORD CEDAR	WESTERN RED CEDAR	ALL TREE SPECIES	
	Healthy	*P. weirii* infected	Other Disease or Windthrow	Healthy	*P. weirii* infected	Healthy	Healthy	Healthy	Diseased or Windthrown
8	13.75	2.29	2.29	2.29	0.0	0.0	2.29	18.33	4.58
10	19.07	2.93	2.20	2.93	0.73	0.0	2.93	24.93	5.86
12	17.31	4.58	0.51	1.02	0.0	0.59	1.02	19.94	5.09
14	15.72	1.87	0.37	0.75	0.0	0.0	0.37	16.84	2.24
16	12.89	0.29	0.0	0.29	0.0	0.0	0.0	13.18	0.29
18	8.60	0.23	0.45	0.23	0.0	0.0	0.0	8.83	0.68
20	4.77	0.37	0.18	0.0	0.0	0.0	0.0	4.77	0.55
22	2.88	0.30	0.0	0.0	0.0	0.0	0.0	2.88	0.30
24	0.76	0.13	0.0	0.13	0.0	0.0	0.0	0.89	0.13
26	0.43	0.0	0.0	0.0	0.0	0.0	0.0	0.43	0.0
28	0.37	0.0	0.0	0.0	0.0	0.0	0.0	0.37	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.14	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42+	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
All Classes	96.73	12.99	6.0	7.64	0.73	0.59	6.61	111.57	19.72

TABLE 3. Mean volume per acre (bd. ft.) in Block A of Burnt Mountain Unit

DBH Class (in.)	DOUGLAS-FIR			WESTERN HEMLOCK		PORT ORFORD CEDAR	WESTERN RED CEDAR	ALL TREE SPECIES	
	Healthy	*P. weirii* infected	Other Disease or Windthrow	Healthy	*P. weirii* infected	Healthy	Healthy	Healthy	Diseased or Windthrown
8	618.8	103.1	103.1	194.7	0.0	0.0	84.7	898.2	206.2
10	1,144.2	175.8	132.0	322.3	80.3	0.0	146.5	1,613.0	388.1
12	1,817.6	480.9	53.6	132.6	0.0	41.3	71.4	2,062.9	534.5
14	2,751.0	327.3	64.8	120.0	0.0	0.0	35.2	2,906.2	392.1
16	3,351.4	75.4	0.0	58.0	0.0	0.0	0.0	3,409.4	75.4
18	2,924.0	78.2	153.0	66.7	0.0	0.0	0.0	2,990.7	231.2
20	2,098.8	162.8	79.2	0.0	0.0	0.0	0.0	2,098.8	242.0
22	1,656.0	172.5	0.0	0.0	0.0	0.0	0.0	1,656.0	172.5
24	524.4	89.7	0.0	68.9	0.0	0.0	0.0	593.3	89.7
26	365.5	0.0	0.0	0.0	0.0	0.0	0.0	365.5	0.0
28	366.3	0.0	0.0	0.0	0.0	0.0	0.0	366.3	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	192.5	0.0	0.0	0.0	0.0	0.0	0.0	192.5	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42+	112.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0	0.0
All Classes	17,922.5	1,665.7	585.7	963.2	80.3	41.3	337.8	19,264.8	2,331.7